



Infrared, Inc.

Non-Intrusive Liquid Level Detection System

Technology Need:

Radiologically contaminated pipes, vessels and other enclosures are a major concern within the Department of Energy (DOE) and in private sector facilities which are scheduled to undergo deactivation and decommissioning (D&D). A first step in evaluating the potential hazards of these objects is the determination of the presence of liquids. A technology is needed for performing surveys on these enclosures to provide information on the presence or absence of liquid.

Technology Description:

Infrared Imaging Technology offers a non-intrusive method to determine if liquids are present in piping, vessels and other enclosures. Infrared thermography is the process of converting heat emitted from an object into a visible, dynamic, TV-like picture. This system uses infrared thermography to assay tanks and equipment for the presence of liquids. As such, liquid level information in tanks or equipment can be obtained for use in planning D&D activities.

Infrared Inc. has developed and demonstrated a Non-Intrusive Liquid Level Detection System (NLLDT). The NLLDT system provides an attractive alternative to the baseline technologies that employ mechanical methods of opening tanks, vessels and piping assemblies to detect liquids or other foreign materials.

NLLDT is the use of infrared thermography coupled

with either normal ambient temperature changes or local, low-level heating or cooling to passively and non-intrusively detect liquids in tanks and piping. Specifically, infrared imaging cameras are used along with specialized implementation procedures to exploit physical property variations in the tanks/pipes and contained liquid to produce temperature contours of images that identify the liquid levels.

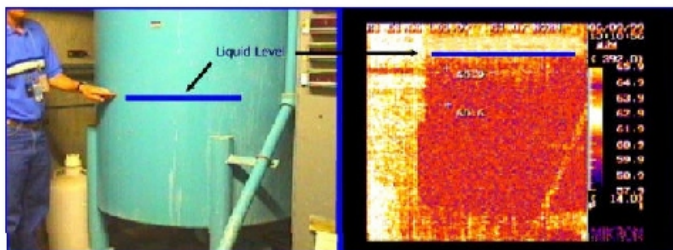
By creating a detailed two-dimensional temperature pattern (thermogram) of the surveyed surface, information on temperature is obtained from several thousand points in the field of view of the scanner, or detector array, in about one thirtieth of a second. A typical thermographic scanning unit produces a thermal image 30 times each second detecting temperature differentials as low as 0.2°C at ambient temperature.

Infrared-imaging cameras consist of five or more basic parts: optical components, filter, detector, electronics, and temperature display. Two Infrared Imaging Cameras were utilized in the demonstration of the detection of liquid levels in tanks and piping. Both cameras were full color radiometers and operated in the 3 to 5 and 7 to 14 micron wavebands respectively.

Benefits:

Used as part of a complete piping and container survey program, infrared technology offers a number of distinct advantages over the baseline technology approach to the inspection of these vessels including:

- NLLDT eliminates the need to physically open and inspect vessels, thus decreasing the risk to workers by reducing or eliminating exposure to radioactive or hazardous materials associated with gaining access to these objects
- NLLDT produces results more quickly, thus



accelerating the characterization schedule

- ▶NLLDT is significantly less expensive than baseline technologies
- ▶NLLDT does not generate any significant secondary waste
- ▶NLLDT is readily adaptable for remote deployment

Status and Accomplishments:

Infrared Inc. deployed the NLLDT at Hanford's 221-U Facility in June and July 1999 to assay selected equipment for the presence of liquid. This information was gathered in support of the Canyon Disposition Initiative (CDI) Project. Ten target vessels and a number of piping assemblies located on the canyon deck of the 221-U facility were selected for evaluation.

The selection factors for deployment included the following:

- ▶Ability to detect liquids or other foreign matter in vessels and piping assemblies
- ▶Ability to operate in a radiologically contaminated environment and to perform the demonstrations in such a way as to minimize or avoid contamination
- ▶Easy to decontaminate with conventional practices
- ▶Ability of the computer and software to analyze data

Infrared and visual cameras were positioned to capture a timed sequence of approximately 30 images per target. Images were analyzed to characterize the enclosures using computer software. The NLLDT system is ready for deployment throughout the DOE complex.

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NLLDT being demonstrated at Hanford

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Online Resources:

Office of Science and Technology, Technology Management System (TMS), Tech ID # 2403
<http://ost.em.doe.gov/tms>

The National Energy Technology Laboratory Internet address is <http://www.netl.doe.gov>

For additional information, please visit Infrared Inc.'s website at <http://www.infrared.com/>

An Innovative Technology Summary Report (ITSR) is available for the NLLDT system on OST's website <http://ost.em.doe.gov/efd/ddfa/itsrs/itsr2403/itsr2403.pdf>